

## Charmed states on the lattice

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Study of the charmonium states play important role in understanding of the strong interaction. The most interesting charmonium states lie near or above open charm threshold. Nature of such states is of interest to modern physics. Recent lattice calculations have performed the necessary extrapolations and considered spectra as well as certain radiative transitions. The lattice QCD simulations of  $X(3872)$  with  $J^P C = 1^{++}$  have been performed in this study. The mass of this state, 3872 MeV, is very close to the sum of the masses of the  $D_0$  and  $D_0^*$  mesons and decays to  $D_0$  and  $D_0^*$  were observed, giving rise to two other explanations for what the mysterious  $X$  could be: a loosely-bound “molecule” of the  $D_0$  and  $D_0^*$  mesons, or a “tetra-quark” binding a di-quark and a di-antiquark. We also have proposed the approach to determine the nature of this state.

### Summary

**Primary author:** Dr LUSHCHEVSKAYA, Elena (ITEP)

**Presenter:** Dr LUSHCHEVSKAYA, Elena (ITEP)

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